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CLAIMS

[Claim(s)]

[Claim 1] An optical probe device which obtains an optical tomogram using low coherence light, comprising:

A flexible sheath in which the tip side was formed for a good raw material of a light transmittance state at least.

Said outgoing radiation and incidence part of a low interference light provided in said sheath lumen

Housing which has said said outgoing radiation and incidence part of a low interference light.

A flexible shaft which is connected with said housing and transmits rotation from a driving means of a rear end part.

A housing station keeping means to hold said housing to a position at a tip of said sheath.

[Claim 2] The optical probe device comprising according to claim 1:

A locking means which said housing station keeping means stops in contact with a end face side of said housing.

A sheath major key ready means to make a end face side of said housing contact said locking means, and to adjust the length of said sheath to said flexible shaft in the direction of a longitudinal shaft at a tension ***** sake.

[Claim 3] The optical probe device comprising according to claim 1:

A locking means which said housing station keeping means stops in contact with a end face side of said housing.

A friction prevention means which an apical surface of said housing contacts.

A shaft terminal area which connects a base end of said flexible shaft.

A shaft terminal area sliding means which is slidable in the direction of a longitudinal shaft in said shaft terminal area, and transmits rotation to said shaft terminal area from said driving means.

[Claim 4] An optical probe device given in claims 1 thru/or 3 having a resectable excision means for a body tissue near [into which said low interference light emitted from said outgoing radiation and incidence part enters] a position.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention irradiates analyte with low coherence light, and relates to the optical probe device for building the tomogram for analyte from the information on the lights scattered in analyte.

[0002]

[Description of the Prior Art] In recent years, when diagnosing a body tissue, OCT (optical coherence tomography) of the interference pattern which obtains the tomogram to analyte is indicated by for example, the Patent Publication Heisei No. 511312 [six to] gazette, using low coherence light as a device which can acquire the optical information of an in-house part.

[0003] An optical probe device which has the flexible shaft in which the tip unit which serves as an optical fiber, and optical outgoing radiation and an incidence part inside to the tube shape sheath of the outside for inserting into the abdominal cavity in the Patent Publication Heisei No. 511312 [six to] gazette was provided, and which was constituted pivotable (hereafter) The optical probe or the probe, and the brief sketch are only indicated.

[0004]

[Problem(s) to be Solved by the Invention] However, in the conventional optical probe, Since a flexible shaft will touch a tube shape sheath inner surface and the relative length of a tube shape sheath and a flexible shaft will change, if a tube shape sheath curves, When the tip clearance of the point inner face of a tube shape sheath and the apical surface of a tip unit is small, and the solid of revolution of a sheath tip part and an inside runs, rotationability falls and there is a fault -- a proper OCT picture is no longer acquired.

[0005] Since the relative length of a tube shape sheath and a flexible shaft will change as mentioned above if this tip clearance (crevice) is large, Since the position of optical outgoing radiation and the incidence part of a tip unit changes, it becomes difficult for a way person to grasp an optical emitting position, and there is a problem that the operativity of the way person at the time of observation gets worse.

[0006] In light of the above-mentioned circumstances, this invention makes tip clearance the minimum and an object of this invention is to provide the optical probe device which can hold an optical emitting position in a proper position.

[0007]

[Means for Solving the Problem] An optical probe device of this invention comprises:

A flexible sheath in which the tip side was formed for a good raw material of a light transmittance state at least in an optical probe device which obtains an optical tomogram using low coherence light.

Said outgoing radiation and incidence part of a low interference light provided in said sheath lumen

Housing which has said said outgoing radiation and incidence part of a low interference light.

A flexible shaft which is connected with said housing and transmits rotation from a driving means of a rear end part, and a housing station keeping means to hold said housing to a

position at a tip of said sheath.

[0008]

[Embodiment of the Invention] Hereafter, an embodiment of the invention is described, referring to drawings.

[0009] The lineblock diagram showing the entire configuration of the optical imaging instrument with which drawing 1 was provided with the optical probe device by drawing 1 thru/or drawing 7 with respect to a 1st embodiment of this invention, The figure in which drawing 2 shows the endoscope in which the optical probe device of drawing 1 is inserted, the lineblock diagram in which drawing 3 shows the composition at the tip of the optical probe device of drawing 1, The lineblock diagram in which drawing 4 shows the composition of the end face of the optical probe device of drawing 3, the sectional view in which drawing 5 shows the A-A line section of drawing 4, the figure with which drawing 6 explains connection between the optical probe device of drawing 1 and a rotary drive, and drawing 7 are the lineblock diagrams showing the composition of the modification at the tip of the optical probe device of drawing 3.

[0010] The optical imaging instrument (optical fault image device) 1 shown in drawing 1 has formed the low coherence light sources 2, such as a super-high-intensity light emitting diode (the following, SLD, and brief sketch), in the observation device 27. That wavelength is 1300 nm and this low coherence light source 2 is provided with the feature of low coherence light which shows coherence only in the short range scale of as [whose coherence length of that is about 17 micrometers].

[0011] That is, when the difference of two light path length to the point mixed from the point which branched when it was mixed again, after branching this light to two is in the short range scale which is about 17 micrometers, it is detected as a light in which it interfered, and when light path length is larger than it, the characteristic in which it does not interfere is shown.

[0012] The light of this low coherence light source 2 enters into the end of the 1st single mode fiber 3, and is transmitted to the end face (apical surface) side of another side. This 1st single mode fiber 3 is combined in the intermediate optical coupler part 4 as optically as the 2nd single mode fiber 5. Therefore, it is branched and transmitted to two in this optical coupler part 4.

[0013] In the tip (optical coupler part 4) side of the 1st single mode fiber 3. The optical rotary joint 6 which performs combination which can transmit light by the non rotating part and a rotary part is inserted, At the tip of the 3rd single mode fiber 7 in this optical rotary joint 6, an optical probe device of a 1st embodiment. (The following and an optical probe brief sketch) The connector area 9 of 8A can detach and attach freely, and it is connected, and it is inserted in in this optical probe 8A, and the light of the low coherence light source 2 is transmitted to the 4th single mode fiber 10 to rotate (light guide).

[0014] And the transmitted light is irradiated, being scanned from the tip side of the optical probe 8A at the body tissue 11 side as analyte. A part of catoptric light carried out, such as dispersion the surface or inside the body tissue 11 side, is incorporated, It returns to the 1st

single mode fiber 3 side through a reverse optical path, the part moves to the 2nd single mode fiber 5 side by the optical coupler part 4, and it enters into the photo-diode 12 as a photodetector from the end of the 2nd single mode fiber 5. The rotor side of the optical rotary joint 6 is rotated with the rotary drive 13.

[0015]The variable mechanism 14 of the light path length who changes the light path length of standard light is formed in the tip side from the optical coupler part 4 of the 2nd single mode fiber 5. 1st light-path-length change means by which only the light path length of this scanning zone changes at high speed corresponding to the light path length to whom this light path length's variable mechanism 14 scans only a predetermined scanning zone to the depth direction of the body tissue 11 with the light-scanning probe 8, It has the change means of the 2nd light path length who can change the light path length about the variation in the length so that the variation in the length of each optical probe 8A at the time of exchanging and using the optical probe 8A can be absorbed.

[0016]It counters at the tip of the 2nd single mode fiber 5, and is attached on the 1 axis stage 18 with this tip, and the grating 16 is arranged via the collimate lens 30 which can move in the direction shown in the arrow a freely. moreover -- passing this grating (diffraction grating) 16 -- a minute angle -- the rotatable galvanometer 19 is attached as the 1st light path length's change means, and by the galvanometer controller 20, this galvanometer mirror 19 vibrates in rotation at high speed, as the numerals b show.

[0017]This galvanometer mirror 19 is reflected by the mirror of a galvanometer, and the mirror which impressed the driving signal of exchange to the galvanometer and was attached to that movable part is vibrated in rotation at high speed.

[0018]That is, a driving signal is impressed by the galvanometer controller 20 so that only a predetermined distance can be scanned at high speed to the depth direction of the body tissue 11 with the optical probe 8A, and as the numerals b show with this driving signal, it vibrates in rotation at high speed.

[0019]And it is emitted from the end face of the 2nd single mode fiber 5 by this rotation vibration, and only the scanning zone of a predetermined distance which the light path length of the light which is reflected by the galvanometer mirror 19 and returns scans to the depth direction of the body tissue 11 changes.

[0020]That is, the change means of the 1st light path length for obtaining the tomogram for a depth direction is formed by the galvanometer mirror 19. The change means of the light path length by this galvanometer mirror 19 is indicated by SCIENCE VOL.276, 1997, and pp2037-2039.

[0021]The 2nd single mode fiber 5 and collimate lens 30 are provided on the freely movable 1 axis stage 18, as the numerals a show to the optical axis direction, and they serve as the 2nd light path length's change means.

[0022]The fiber loop 29 for the polarization plane control for removing the influence of the birefringence produced by bending of the whole interference system which comprises a fiber, and the fiber in the optical probe 8A is formed in the 2nd single mode fiber 5.

[0023]On the other hand, the 1 axis stage 18 forms the variable means of the 2nd light path length who has a variable range of only the light path length who can absorb the variation in the light path length of the optical probe 8A to the case where the optical probe 8A is exchanged, and. The position considered as a request when ****(ing) light path length by the galvanometer mirror 19 and acquiring the picture of a depth direction. (For example, even when the tip of the optical probe 8A has not stuck on the surface of a body tissue, by changing the light path length by the 1 axis stage 18) He is trying to also have the function of an adjustment device to adjust offset so that it can image from the surface position, by setting it as the state of interfering from the surface position of the body tissue 11.

[0024]This 1 axis stage 18 is provided with the motor for stage movement, and moves in the direction shown with the numerals a in the 1 axis stage 18 by impressing a driving signal to that motor with the position control apparatus 21.

[0025]It is mixed with the light which leaked from the 1st single mode fiber 3 side in the coupler part 4 provided in the middle of the 2nd single mode fiber 5, and the light into which light path length was changed by this light path length's variable mechanism 14 is received with both the photo-diodes 12.

[0026]The light path length from the optical coupler part 4, for example to [after the 2nd single mode fiber 5 has set up the 1 axis stage 18 near the mid-position of the variable range / from the tip of the optical probe 8A] the body tissue 11 through the 4th single mode fiber 9 grade, pass the 2nd single mode fiber 5 -- the light path length reflected by the galvanometer mirror 19 on the 1 axis stage 18 -- abbreviation -- it is set up become equal length.

[0027]And by carrying out variable setting out of the position of the 1 axis stage 18 according to the optical probe 8A used actually connecting, By absorbing the variation in the length of each optical probe 8A (the 4th inner single mode fiber 10), and rotation vibrating or high-speed vibrating the galvanometer mirror 19 at high speed, and changing periodically the light path length of the standard light side, The catoptric light in the depth position of the body tissue 11 used as a value equal to this light path length is made to interfere, and it enables it to make the catoptric light in other depth portions into noninterfering.

[0028]After the signal by which photoelectric conversion was carried out with the above-mentioned photo-diode 12 is amplified by AMBU 22, it is inputted into the demodulator 23. In this demodulator 23, recovery processing which extracts only the signal part of light in which it interfered is performed, and that output is inputted into the computer 25 through A/D converter 24. The image data corresponding to a tomogram is generated, it outputs to the monitor 26, and the OCT image 26a is expressed to that display surface as this computer 25.

[0029]This computer 25 is connected with the position control apparatus 21, and the computer 25 controls the position of the 1 axis stage 18 via the position control apparatus 2. The computer 25 is connected with the video synchronous circuit 28, and tomogram data is stored in an internal memory synchronizing with the video synchronizing signals at the time of imaging.

[0030]The video synchronizing signals of this video synchronous circuit 28 are sent also to the

galvanometer controller 20 and the rotary drive 13, respectively, For example, the galvanometer controller 20 outputs a driving signal with the cycle in sync with video synchronizing signals (the 1st high-speed video synchronizing signals [in / specifically / two video synchronizing signals a high speed and a low speed,]), The rotary drive 13 outputs the driving signal which synchronized with the 1st video synchronizing signals with the cycle in sync with video synchronizing signals (specifically the 2nd low-speed video synchronizing signals), and he is trying to scan light to a hoop direction by rotation by the rotary drive 13.

[0031]The optical probe 8A of a 1st embodiment can make the tip side of the tip opening to the optical probe 8A project through the channel for forceps insertion from the forceps insertion port 32 of the endoscope 31, as shown in drawing 2.

[0032]It has the flexible insert portion 33 by thin length so that it may be easy to insert this endoscope 31 into the abdominal cavity, and the wide-width final controlling element 34 is formed in the back end of this insert portion 33. The forceps insertion port 32 is formed near the back end of this insert portion 33, and this forceps insertion port 32 is open for free passage with the channel for forceps insertion by that inside.

[0033]The light guide which is not illustrated is inserted in in the insert portion 33, the incidence edge of this light guide is connected to light equipment, it is emitted from the lighting window which transmitted the illumination light and was provided in the tip part of the insert portion 33, and the affected part etc. are illuminated. A lighting window is adjoined and an observation port is provided, and an objective optical system is attached to this observation port, and it enables it to observe the affected part etc. which were illuminated to an optical system. And it irradiates with low coherence light, the fault image data inside the body tissue 11 is obtained, and it enables it to display the OCT image 26a on the display surface of the monitor 26 with the optical probe 8A under observation of the observation optical system of the tip part of the endoscope 31 at the body tissue 11 side of the portion which the affected part etc. observe.

[0034]The bend 35 and (endoscope) the tip part 36 are formed in the tip part of the insert portion 33. When making the tip 37 of the optical probe 8A project from the endoscope tip part 36 and making [making the optical probe 8A insert through the bend 35, and] the body tissue 11 touch, as shown in drawing 2, the tip part 36 of the optical probe 8A curves with a small curvature radius.

[0035]As shown in drawing 3 thru/or drawing 5, the optical probe 8A, The optical sheath 38 which comprised a long and slender tubular resin tube to which the peripheral face carried out adhesion fixing of the transparent tip sheath 38a by the spool jointing 38b via 38 d of locking members at least, The connector area 9 which connects the back end side of this optical sheath 38 to the rotary drive (an observation device is constituted) 13, The flexible shaft 40 which comprises the coil 44 which was provided inside the optical sheath 38 and rolled spirally and which rotates free and transmits torque, The 4th single mode fiber 10 provided in the lumen of the flexible shaft 40, It has with the rotation transmission connector 42 connected to the back end of the flexible shaft 40 which has the ferrule 104 connected to the tip unit 39 which serves

as optical outgoing radiation and an incidence part by which connection maintenance is carried out at the tip of the flexible shaft 40, and the back end of the 4th single mode fiber 10.

[0036]The selfoc lens 45 which condenses the light from the end of the 4th single mode fiber 10 in the tip unit 39 which can rotate freely to the tip side of the optical sheath 38, and is arranged, The prism 51 which reflects the condensed light on a slant face, and is emitted to rectangular directions is formed, These are covered with the tip housing (only housing brief sketch) 52 which has the window part 46 used as outgoing radiation and the incidence part of the light from the prism 51 (it is attached at the tip of the flexible shaft 40, and is ****).

[0037]The tip of the tip sheath 38a fixes the sealing member 38c by the spool jointing 38b, and is closing the tip watertight. The rear end face of 38 d of locking members and the tip housing 52 contacts.

[0038]Other than tip sheath 38a of the optical sheath 38, as long as it is flexible, it may not necessarily be transparent. 38 d of locking members also perform junction in the tip of the optical sheath 38, and the tip sheath 38a.

[0039]It slides on the rotation transmission connector 42 connected to the back end of the flexible shaft 40 with the ball bearing 101, and it is held centering on the center of the outer cylinder member 103 of the connector area 9 by the bearing 102, enabling free rotation. The back end of the 4th single mode fiber 10 is inserted in a center with high precision at the ferrule 104 which is a member generally used by optical communications as a connector of an optical fiber, and optical polish is carried out in the rear end face of the ferrule 104.

[0040]The male screw part 106 which the back end of the optical sheath 38 was fixed to the sheath stop member 105, and was formed in the peripheral face of the sheath stop member 105, and the female screw portion 107 formed in the inner surface of the outer cylinder member 103 screw. If the screwing position by the male screw part 106 and the female screw portion 107 mentioned later is decided, in order to prevent a motion of the sheath stop member 105, the sheath stop member 105 is fixed to the outer cylinder member 103 with the set screw 108. It is covered with the member 109 that the tip of the outer cylinder member 103 should stop breaking, and the member 109 is connected by O ring 110 watertight stop breaking into the outer cylinder member 103.

[0041]The ferrule 104 is being fixed to the ferrule receptacle 111, and this ferrule receptacle 111 is connected to the rotation transmission connector 42 via the spring 41a.

[0042]About connection between the connector area 9 and the rotary drive 13, If the outer cylinder member 103 is joined to the loading slot 114 of the rotary drive 13 as shown in drawing 6, the insertion amount will be prescribed by the major axis direction distance of the cam pin 115 provided in the peripheral face of the outer cylinder member 103, and the cam groove 116 formed in loading slot 114 inner surface.

[0043]On the other hand, the tip of the 3rd single mode fiber 7 in the optical rotary joint 6 is inserted in the ferrule 117 with high precision at a center, and optical polish is carried out by the apical surface of the ferrule 117.

[0044]It is fixed to the sleeve 119 formed in the medial axis of the connecting member 118

connected with the rotation transmission connector 42, and the ferrule 117 rotates the connecting member 118 by the motor 120. The belt pulley 121 formed in the axis of rotation of the motor 120 in detail and the pulley portion 122 provided in the peripheral face of the connecting member 118 are connected by the synchronous belt 123, and rotation of the motor 120 is transmitted to the connecting member 118. Rotation of the motor 120 is controlled by the roll control circuit 131 which is detecting the rolling state with the encoder 130 formed in the axis of rotation of the motor 120.

[0045]And if the outer cylinder member 103 is inserted in the position of the loading slot 114 of the rotary drive 13, torque will be transmitted to the rotation transmission connector 42 because the rotation transmission pin 124 formed in the back end of the rotation transmission connector 42 fits into the transmission grooves 125 formed at the tip of the connecting member 118.

[0046]In this state, within the sleeve 119, the ferrule 104 and the ferrule 117 contact and optical connection is carried out. At this time, the ferrule 104 and the ferrule receptacle 111 are moved in the direction of a tip, and the spring 41a is compressed. Press fixation of the ferrules is carried out by the reaction force of this spring 41a. At this time, the ferrule receptacle 111 is [only being supported by the spring 41a and], and will be floated within the rotation transmission connector 42. When the center of rotation of a probe and the center of rotation of an actuator may shift on the accuracy of processing and an assembly and it rotates in this state, stress is applied to the sleeve 119 and the ferrule 104, and it may have an adverse effect on optical connection.

[0047]According to this embodiment, since it will be floated within the rotation transmission connector 42 while the ferrule receptacle 111 is supported by the spring 41a, **** of the center of this rotation is absorbable.

[0048]Since the inclined part 111a has provided in the ferrule receptacle 111, when a probe is removed, since the ferrule receptacle 111 returns to the original position while alignment is insured by the center, it can be smoothly connected with the ferrule 104 at the time of next attachment and detachment, without the physical relationship of the sleeve 119 shifting.

[0049]By what the baffle 112 formed in the rotation transmission connector 42 fits in with the notch section 113 provided in the outside surface of the ferrule receptacle 111 as shown in drawing 5 which is an A-A line section of drawing 4. Fitting of the rotation transmission pin 124 and the transmission grooves 125 is insufficient, and the ferrule 104 inserted in the sleeve 119 in the state where the rotation transmission connector 42 is not rotating is prevented from rotating.

[0050]In rotation the rotation transmission connector 42 within the connector area 9 by being held free and watertight, also making the connector area 9 into watertight construction, and the whole optical probe 8A's being watertight construction, and using [it is / the index matching water for acid resisting / full, and] it for an inside, (It makes for the difference of the refractive index by the refractive index of small air in the meantime to be in a large state into the almost same refractive index with index matching water to the prism 51 of the optical unit 39, and the

refractive index of a sheath) Reflection in the interface of them is reduced, The optical probe 8A is simply disinfected with an antibacterial etc., it inserts (passing the channel of direct or an endoscope), and use has become possible [make it possible to acquire the good OCT image of image quality, and] in the abdominal cavity (since it is watertight construction).

[0051]And the light transmitted by the 3rd single mode fiber 7 is transmitted to the 4th single mode fiber 10 by an optical connector. The rotation by the rotary drive 13 is transmitted to the flexible shaft 40 by the rotation transmission connector 42.

[0052]It is transmitted to the tip unit 39, and total internal reflection is carried out by the prism 51 of this tip unit 39 on that slant face, an emission direction is changed into rectangular directions, and the transmit light of the 4th single mode fiber 10 is emitted outside as inspection light through the optical sheath 38 via the window part 46. And the catoptric light from a body tissue is received and it transmits to the 4th single mode fiber 10 again. Since the tip of the FUREKISHIBU shaft 40 is connected to the tip unit 39, the flexible shaft 40, the tip unit 39, and the 4th single mode fiber 10 rotate by one.

[0053]In the hand side of the optical probe 8A of this embodiment constituted in this way, it slides with the ball bearing 101, it is supported by the bearing 102, the rotation transmission connector 42 whole rotates, and rotation is told to the flexible shaft 40. The relative position of the flexible shaft 40 and the optical sheath 38 changes with the quantity which thrusts the sheath stop member 105 by the side of the hand by the male screw part 106 and the female screw portion 107 into the outer cylinder member 103. If it thrusts so that the optical sheath 38 may move in the direction of a tip to a main part, and quantity is changed, the rear end face of the tip housing 52 will contact 38 d of locking members someday.

[0054]Since the length of the flexible shaft 40 is specified at intervals of the locking part and the shaft stop member 105 which are 38d of locking members at a tip if the optical sheath 38 is furthermore moved, the flexible shaft 40 is extended by elastic deformation.

[0055]Therefore, it will be contacted by 38 d of locking members while the tip housing 52 imposes a tension on a hand side direction in a rear end face at the flexible shaft 40.

[0056]Therefore, even if the optical probe 8A curves and the inner surface of the flexible shaft 40 touches the inner surface of the optical sheath 38 at the time of optical probe 8A use, Movement of the tip housing 52 is offset by the stretch amount of the flexible shaft extended beforehand, and the tip housing 52 rotates in the always same position to a probe longitudinal direction.

[0057]As mentioned above, in this embodiment, since the tip housing 52 does not move, the dead space at a tip is made small, and a way person's user-friendliness improves at the time of observation. Since the tip housing 52 does not move, a beam emitting position does not change but a way person tends to grasp a beam emitting position.

[0058]Since it is stabilized and the optical connection of the ferrule 104 and the ferrule 117 can be carried out, can reduce light loss and it leads to improvement in image quality, and attachment and detachment of the ferrule 104 can be ensured.

[0059]By what ***** is also good and carries out for the tip bearing 151 which consists of

hard resin, for example, Dirline, polycarbonate, etc. to such composition between the rear end face of the tip housing 52, and 38 d of locking members as shown in drawing 7. By the tip bearing 151, friction of the tip housing 52 and 38 d of locking members is reduced, and rotation of the flexible shaft 40 is transmitted smoothly.

[0060]They are a lineblock diagram in which, as for drawing 8 and drawing 9, drawing 8 shows the composition at the tip of an optical probe device with respect to a 2nd embodiment of this invention, and a lineblock diagram for which drawing 9 shows the composition of the end face of the optical probe device of drawing 8.

[0061]Since a 2nd embodiment is almost the same as a 1st embodiment, only a different point is explained, the same numerals are attached to the same composition, and explanation is omitted.

[0062]As shown in drawing 8, in this embodiment in the tip of the optical probe 8A. The crater part 202 is formed at the tip at the tip 52 of housing at the inner surface of the kurtosis part 201 and the sealing member 38c, friction by the rotation which the kurtosis part 201 and the crater part 202 are made to contact by point contact is prevented, and the rear end face of the tip housing 52 is made to contact 38 d of locking members.

[0063]As shown in drawing 9, in the back end of the optical probe 8A. The pin 204 which formed the shaft stop member 203 which connects the back end of the flexible shaft 40, and was formed in the peripheral face of the shaft stop member 203 by fitting into the oblong hole 205 formed in the rotation transmission connector 42 slidably. The migration length of the direction of a longitudinal shaft of the shaft stop member 203 is regulated transmitting rotation to the flexible shaft 40.

[0064]According to this embodiment constituted in this way, the migration length of the shaft stop member 203 is regulated, transmitting rotation to the flexible shaft 40 by the oblong hole 205 and the pin 204. Even if power which the optical probe 8A curves at the time of optical probe 8A use, the physical relationship of the optical sheath 38 and the flexible shaft 40 changes, and the tip housing 52 moves acts, Since the movement is being fixed at the tip side by the contact to tip housing 52 rear end face and 38 d of locking members by the contact-in kurtosis part 201 and crater part 202, and back end side, the tip housing 52, When the shaft stop member 203 by the side of a hand slides, the movement magnitude will be absorbed.

[0065]Therefore, in this embodiment, the tip housing 52 rotates in the always same position to a probe longitudinal direction. a 1st embodiment -- since it is not necessary to apply a tension to the flexible shaft 40 beforehand like, an assembly becomes easy and productivity can be improved.

[0066]Also in this embodiment, as shown in drawing 7, ***** is also good in the consisting [of hard resin, for example Dirline, polycarbonate, etc.] tip bearing 151 between the rear end face of the tip housing 52, and 38 d of locking members.

[0067]They are a lineblock diagram in which, as for drawing 10 and drawing 11, drawing 10 shows the composition of an optical probe device with respect to a 3rd embodiment of this invention, and a figure for which drawing 11 explains an operation of the optical probe device

of drawing 10.

[0068]Since a 2nd embodiment is almost the same as a 1st embodiment, only a different point is explained, the same numerals are attached to the same composition, and explanation is omitted.

[0069]As shown in drawing 10, the biopsy unit 300 is formed in the tip sheath 38a, the tube 301 which the optical sheath 38 was made to meet from the biopsy unit 300 is made to extend, and the optical probe 8A consists of these embodiments.

[0070]The opening 302 is formed in an optical irradiation position from the tip housing 52, inside the biopsy unit 300 of the opening 302, the sliding blade 304 is regulated in the edge guide 305, and with the wire 306, the biopsy unit 300 is formed in the direction of a longitudinal shaft so that a slide is possible.

[0071]The wire 306 inserted in the inside of the tube 301, and has extended outside watertight and slidably via O ring 308 from the biopsy final controlling element 307 provided in the end face of the tube 301. The end connection 309 which connects to the biopsy final controlling element 307 the suction unit mentioned later and a syringe is formed.

[0072]If the suction unit 310 is connected to the end connection 309 and a lesion is discovered with the optical probe 8A in this embodiment constituted in this way as shown in drawing 11, Using the suction unit 310, attract an organization and the sliding blade 304 cuts from the opening 303 by operating the wire 306, After storing an organization in the biopsy unit 300, the optical probe 8A is taken out from the inside of the abdominal cavity, the organization which stored by connecting the syringe which is not illustrated to the end connection 309, and returning an isotonic sodium chloride solution etc. is taken out from the opening 303, and a biopsy is performed.

[0073]Thus, according to this embodiment, since a biopsy can be carried out simultaneously with observation in addition to the effect of a 1st embodiment, user-friendliness and diagnostic ability improve.

[0074]It cannot be overemphasized that this embodiment can be applied also to the optical probe 8A of a 2nd embodiment.

[0075][Additional remark]

(Additional remark paragraph 1) In the optical probe device which obtains an optical tomogram using low coherence light, The flexible sheath in which the tip side was formed for the good raw material of the light transmittance state at least, The housing which has outgoing radiation and the incidence part of said low coherence light provided in said sheath lumen, and outgoing radiation and the incidence part of said low coherence light, An optical probe device possessing the flexible shaft which is connected with said housing and transmits rotation from the driving means of a rear end part, and the housing positioning means which holds said housing to the position at the tip of said sheath.

[0076](Additional remark paragraph 2) Said housing station keeping means, The locking means stopped in contact with the end face side of said housing, An optical probe device given in the additional remark paragraph 1 consisting of a sheath major key ready means to adjust the

length of said sheath in order to make the end face side of said housing contact said locking means and to add a tension to said flexible shaft at longitudinal *****.

[0077](Additional remark paragraph 2-1) Said sheath major key ready means, The cylindrical sheath end face member which adhered to the back end of said sheath, and the back end end face member which said sheath end face member is connected and holds said flexible shaft in through rotation to the lumen, An optical probe device given in the additional remark paragraph 2, wherein said sheath end face member and said back end end face member consist of a threaded connection which is screwed and connected.

[0078](Additional remark paragraph 3) Said housing station keeping means, The locking means stopped in contact with the end face side of said housing, and the friction prevention means which the apical surface of said housing contacts, An optical probe device given in the additional remark paragraph 1 consisting of a shaft terminal area which connects the foundation stone part of said flexible shaft, and a shaft terminal area sliding means which is slidable to a longitudinal direction in said shaft terminal area, and transmits rotation to said shaft terminal area from said driving means.

[0079](Additional remark paragraph 3-1) Said shaft terminal area sliding means, The cylindrical solid of revolution which is held at the lumen of the back end end face member to which the back end of said sheath is connected, and said back end end face member, enabling free rotation on the Nagate ** and the same axle of said sheath, and makes said shaft terminal area insert in a lumen slidably, An optical probe device given in the additional remark paragraph 3 consisting of an oblong hole formed in the longitudinal direction of the side of said solid of revolution, and a pin which adhered to the outside surface of said shaft terminal area, and was slidably formed in said oblong hole.

[0080](Additional remark paragraph 4) The tip sheath part which said sheath was provided in the tip side and formed for the good raw material of the light transmittance state, An optical probe device given in the additional remark paragraph 2 or 3 consisting of a cylindrical sheath connecting member which carries out connection adherence of the flexible back end sheath part provided in the back end side, and said tip sheath part and said back end sheath part, and providing said locking means in the lumen of said sheath connecting member.

[0081](Additional remark paragraph 5) Optical probe device given in the additional remark paragraph 2 or 3 providing a bearing between said locking means and the end face side of said housing.

[0082](Additional remark paragraph 6) Optical probe device given in claims 1 thru/or 3 having a resectable excision means for the body tissue near [into which said low interference light emitted from said outgoing radiation and incidence part enters] a position.

[0083]

[Effect of the Invention]As explained above, according to this invention, tip clearance is made into the minimum and it is effective in the ability to hold an optical emitting position in a proper position.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The lineblock diagram showing the entire configuration of the optical imaging instrument provided with the optical probe device concerning a 1st embodiment of this invention

[Drawing 2]The figure showing the endoscope in which the optical probe device of drawing 1 is inserted

[Drawing 3]The lineblock diagram showing the composition at the tip of the optical probe device of drawing 1

[Drawing 4]The lineblock diagram showing the composition of the end face of the optical probe device of drawing 3

[Drawing 5]The sectional view showing the A-A line section of drawing 4

[Drawing 6]The figure explaining connection between the optical probe device of drawing 1, and a rotary drive

[Drawing 7]The lineblock diagram showing the composition of the modification at the tip of the optical probe device of drawing 3

[Drawing 8]The lineblock diagram showing the composition at the tip of the optical probe device concerning a 2nd embodiment of this invention

[Drawing 9]The lineblock diagram showing the composition of the end face of the optical probe device of drawing 8

[Drawing 10]The lineblock diagram showing the composition of the optical probe device concerning a 3rd embodiment of this invention

[Drawing 11]The figure explaining an operation of the optical probe device of drawing 10

[Description of Notations]

1A -- Optical imaging instrument

2 -- Low coherence light source

3 -- The 1st single mode fiber

4 -- Optical coupler part

5 -- The 2nd single mode fiber

6 -- Optical rotary joint

7 -- The 3rd single mode fiber

8A -- Optical probe (device)

9 -- Connector area

10 -- The 4th single mode fiber

11 -- Body tissue

13 -- Rotary drive

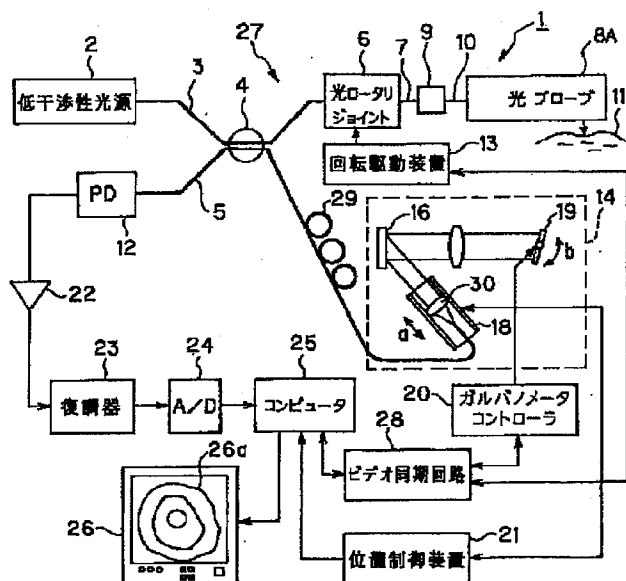
14 -- Light path length's variable mechanism

16 -- Grating

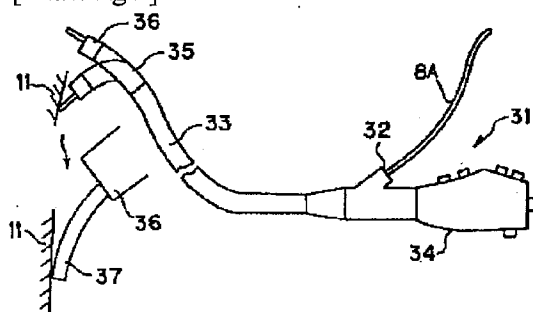
- 18 -- 1 axis stage
- 19 -- Galvanometer mirror
- 20 -- Galvanometer controller
- 21 -- Position control apparatus
- 26 -- Monitor
- 25 -- Computer
- 27 -- Observation device
- 38 -- Optical sheath
- 38a -- Tip sheath
- 38d -- Locking member
- 39 -- Tip unit
- 40 -- Flexible shaft
- 51 -- Prism
- 52 -- Housing
- 103 -- Outer cylinder member
- 105 -- Sheath stop member
- 106 -- Male screw part
- 107 -- Female screw portion

DRAWINGS

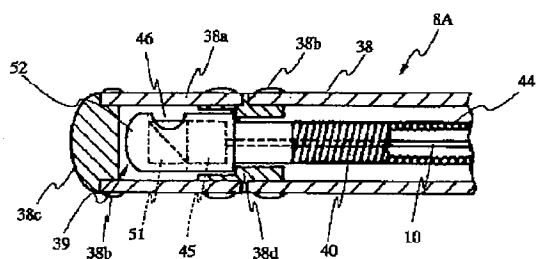
[Drawing 1]



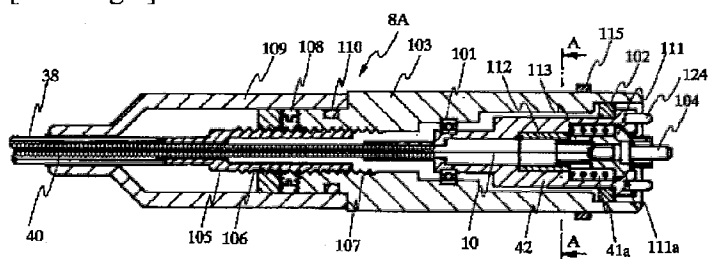
[Drawing 2]



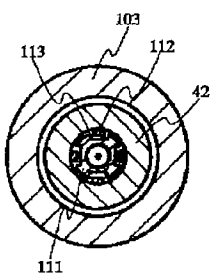
[Drawing 3]



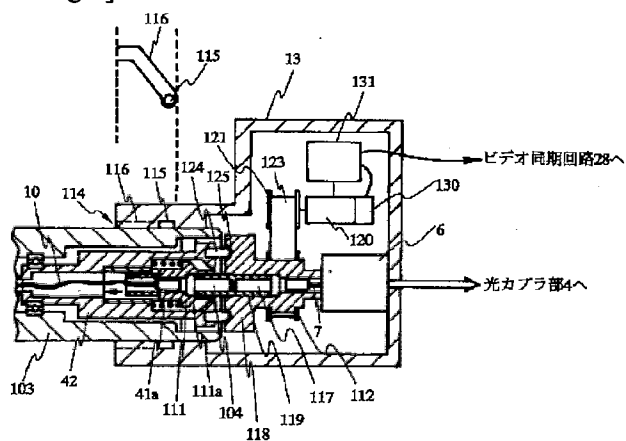
[Drawing 4]



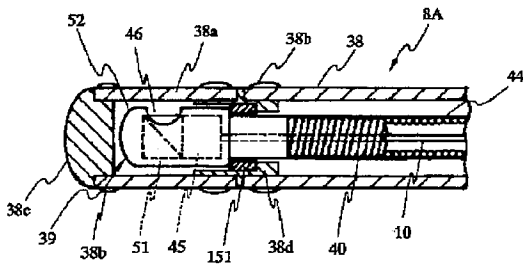
[Drawing 5]



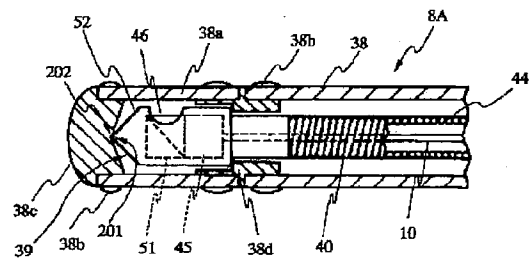
[Drawing 6]



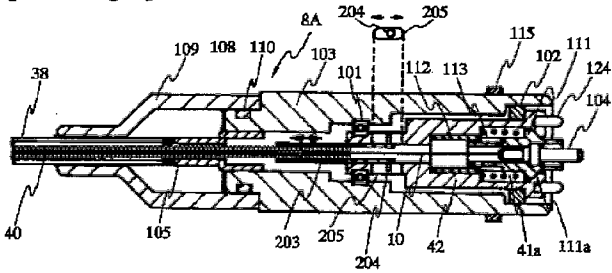
[Drawing 7]



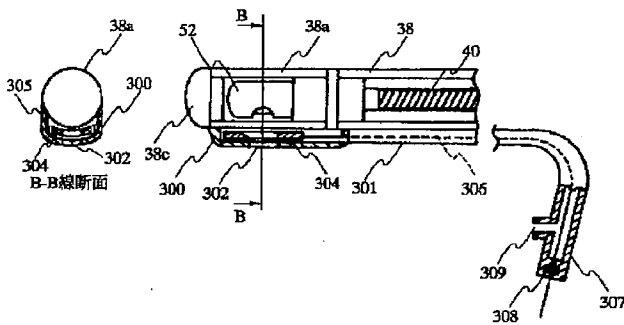
[Drawing 8]



[Drawing 9]



[Drawing 10]



[Drawing 11]

